

Atlas Minerals
Division of Atlas Corporation
Big Indian Mines
LaSal, Utah 84530

File
ACT/015/014
Jim

June 12, 1981

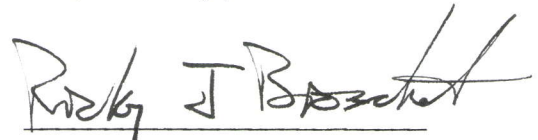
Thomas N. Tetting
Division of Oil, Gas and Mining
1588 West North Temple
Salt Lake City, Utah 84116

Re: Revegetation Test
Plot Research Proposal

Dear Tom,

Enclosed is the Revegetation Test Plot Research Proposal for Atlas Minerals' uranium mines which the Division has requested. Please feel free to contact me with any questions or comments you or others in the Division may have concerning this proposal. To expedite implementation of this program, we would appreciate your prompt reply.

Respectfully,



Ricky J. Broschat
Reclamation Scientist

RJB/v1

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DIVISION OF
OIL, GAS & MINING

ATLAS MINERALS
REVEGETATION TEST PLOT
RESEARCH PROPOSAL

by: Ricky J. Broschat
Reclamation Scientist

June 1, 1981

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DIVISION OF
OIL, GAS & MINING

- PURPOSE -

The purpose of this proposal is to outline a revegetation test plot research program for existing waste rock stockpiles located at Atlas' uranium mines. The current reclamation laws requiring the stockpiling of topsoil prior to the establishment of a mining operation were not in effect when many of Atlas' mines were first opened. Hence, at these mines no topsoil has been saved for reapplication over waste rock generated during the mining cycle. These mines are located in remote regions with little available water. To establish a vegetative community on these nutrient deficient waste rock stockpiles without the aid of topsoil or irrigation is the task we are now faced with.

To avoid costly errors in attempting full scale revegetation and to determine the feasibility of achieving a surface cover of at least seventy percent of the representative vegetative communities which surround Atlas' mine sites, a meaningful and reliable data base must be established. This research is designed to provide data so the controlling factors in meeting this reclamation standard such as soil characteristics, useful plant species, and follow-up care requirements can be determined. The results of this research will provide direction and guidance for future revegetation at Atlas Minerals' operations.

- SITE SELECTION -

To accomplish this purpose, two test plot sites will be established. Site number one will be established at Atlas' #2 mine located in Emery County, approximately twelve miles west of Green River, Utah. This area

was addressed in the Four Corners Mining and Reclamation Plan ACT/015/014. This site, currently inactive, consists of waste rock removed from the Saltwash member of the Morrison formation, one of the two principal formations in which Atlas conducts mining operations. Rainfall at this site is estimated to be from six to eight inches annually.

Site number two will be at the Maria mine located in San Juan County, approximately two miles south of Atlas' general mine office. The Maria mine, which has not operated since 1969, is sited in the Big Indian Valley area where the majority of Atlas' mines are located. Waste rock at this mine was removed from the Mossback member of the Chinle formation, the second of two principal formations in which Atlas conducts mining. Rainfall at this site is estimated to be twelve inches annually.

The selection of these two sites for test plots accomplishes two objectives. First, they provide sites on the two major waste rock soil types which Atlas must reclaim. Second, they provide sites which are located at the low and median precipitation scales which are associated with Atlas' mining operations. Therefore, these sites will provide a good cross section of possible encountered conditions.

- SITE PREPARATION -

At each selected site the waste rock stockpile will be graded level and a material depth of at least four feet will be maintained. Soil samples will then be collected for laboratory analysis of characteristics important in plant establishment and growth. These tests will include, but not be limited to, texture, pH, electrical conductivity, boron, iron,

zinc, available nitrogen, available phosphorus, and available potassium. All soil amendments will be determined from the results of the soil analysis. If necessary, nitrogen, potassium, and phosphorus fertilizers will be applied in sufficient amounts such that their readily available quantities in the soil will not be a limiting factor. If the soil is very acidic, lime will be applied in appropriate quantities to bring the soil pH within the range 5 to 7. All soil amendments will be applied in early summer 1981 and thoroughly disked in. Fencing around each site will be employed to control grazing.

- EXPERIMENTAL PARAMETERS -

Beyond the revegetation limitations inherent in the waste rock, the most probable limiting factor in achieving the reclamation standard described in the purpose section of this proposal will be the amount of available moisture. Theoretically, mulching is a means to conserve soil moisture by reducing the evapotranspiration rate of the soil and young seedlings. To determine if mulching will be beneficial in helping to meet this reclamation standard, one half of the plots at each site will have mulch applied while the other half will not. (See Appendix A)

In order to determine the seeding rate necessary to achieve proper plant density and percentage ground cover, the seeding rate will be varied. One half of the plots will be seeded with 20 pounds of pure live seed per acre, while the other half will be seeded with 35 pounds of pure live seed per acre. (See Appendix A)

The final parameter under study will be the effect of the relative

percentage of shrubs versus grasses in the seed mix. This will enable us to determine the effects of competition between the two groups and may help us to develop an effective seed mix with proper species proportions. Since there is a great variation in the weight of each species' seed, this percentage will not be by weight but by relative number of seeds. One half of the plots will be seeded with a mix high in shrubs and low in grasses, while the other half will be seeded with a mix low in shrubs and high in grasses. (See Appendix A) Each mix will contain the same species, but in different proportions. The exact species to be used will be selected from the list in Appendix B, after the results of the soil analysis have been studied and compared with the environmental requirements of these species.

- TREATMENT METHODS -

All plots will be seeded in late Fall 1981, prior to the first hard frost. The seeds for each treatment will be mixed with rice hulls or other suitable chaff and sown evenly over the appropriate plots. Each plot will then be raked by hand to insure proper seed covering.

Plots which are to have mulch applied will be covered with straw to an average depth of three inches. The straw will be spread by hand directly after seeding and tacked down with an asphalt or other suitable emulsion to prevent scattering by the wind.

- TEST SITE DESIGN -

The test sites will be constructed to study all combinations of the experimental parameters. Thus, there will be nine separate treatments with one being a control. The control treatment will involve no seeding and will consist of nothing beyond the original site preparation. Each of these nine treatments will have three replications for a total of twenty-seven plots per site. (See Appendix A) One additional plot at each site will be used to plant each species under study separately in rows to aid in species identification throughout the growth cycle.

Each plot will be fifteen feet by fifteen feet with a three foot spacing between plots. Each site will have a fenced area of one hundred twenty-nine feet by seventy-five feet which will enclose the twenty-eight test plots.

- MEASUREMENTS AND DATA -

Data will be collected at each site on a bi-monthly basis, when possible, for the purpose of determining plant density, ground cover, and species composition. Plant density measurements will be made using the point-centered quarter method of sampling, while percentage ground cover and species composition measurements will utilize the line intercept method. All calculations will be subjected to statistical analysis. This program will run for a period of five years, during which the results will be continuously analyzed and updated.

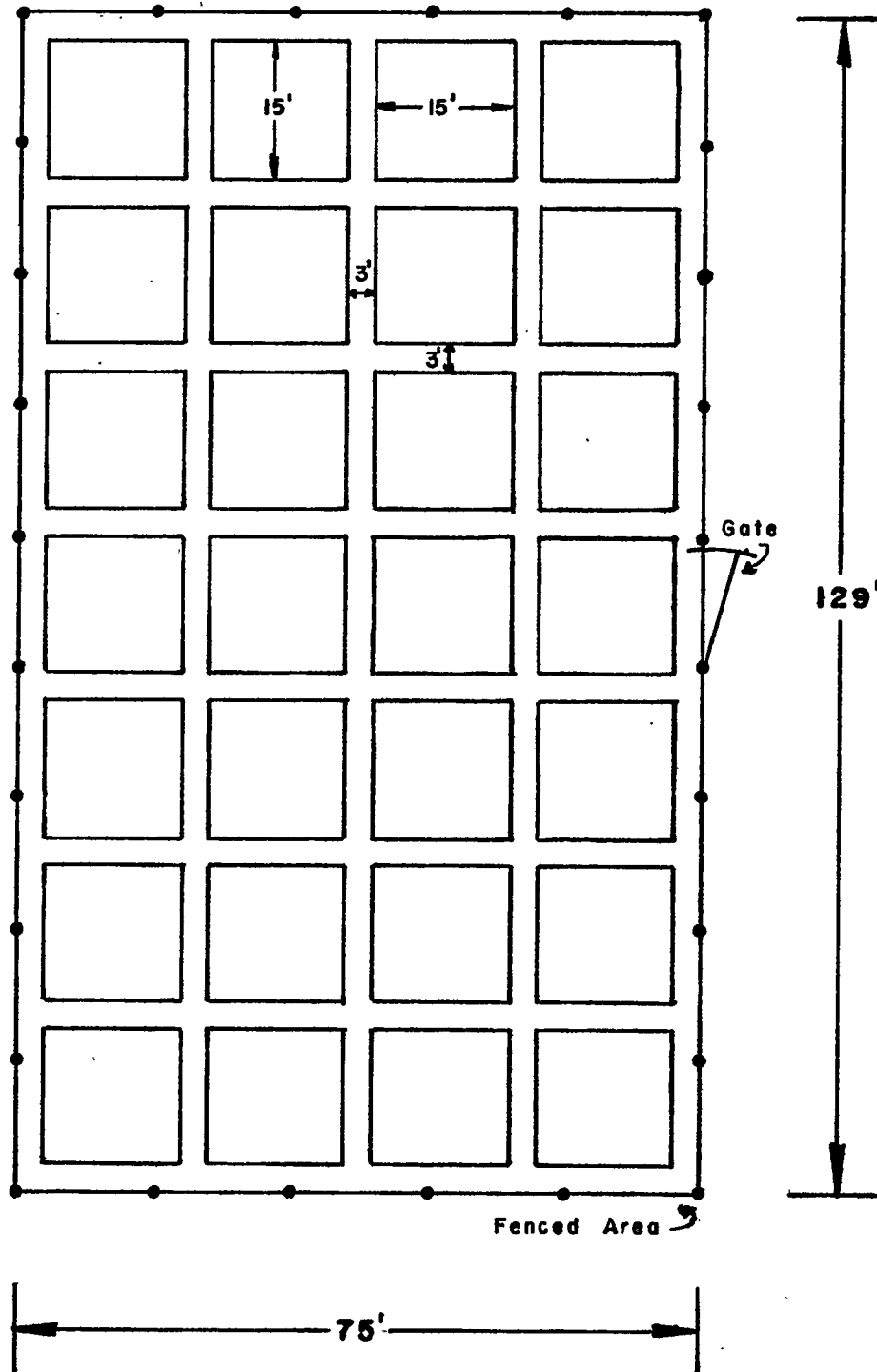
- APPENDIX A -

- Parameters:
1. Mulch
 - A. with mulch
 - B. without mulch
 2. Seed mix
 - A. high % shrubs & forbs, low % grasses
 - B. low % shrubs & forbs, high % grasses
 3. Seeding rate
 - A. 35 pounds PLS per acre
 - B. 20 pounds PLS per acre

	<u>Treatment number</u>								
	<u>VIII</u>	<u>VII</u>	<u>VI</u>	<u>V</u>	<u>IV</u>	<u>III</u>	<u>II</u>	<u>I</u>	<u>0</u>
Parameter combination in each plot	1A	1A	1A	1A	1B	1B	1B	1B	C
	2A	2B	2B	2A	2A	2B	2B	2A	C
	3A	3A	3B	3B	3A	3A	3B	3B	C

Treatment 0 (last column) will act as the control. This gives 9 different treatments with 3 replications of each treatment, for a total of 27 plots at each site.

- APPENDIX A (con't) -



- APPENDIX B -

Grasses

Alkali sacaton - *Sporobolus airoides*
Blue grama - *Bouteloua gracilis*
Bluebunch wheatgrass - *Agropyron spicatum*
Buffalograss - *Buchloe dactyloides*
Crested wheatgrass (Standard) - *Agropyron desertorum*
Crested wheatgrass (Fairway) - *Agropyron cristatum*
Galleta - *Hilaria jamesii*
Indian ricegrass - *Oryzopsis hymenoides*
Inland saltgrass - *Distichlis spicata*
Needle-and-thread - *Stips comata*
Russian wildrye - *Elymus junceus*
Sand dropseed - *Sporobolus cryptandrus*
Streambank wheatgrass - *Agropyron riparium*
Thick spike wheatgrass - *Agropyron dasystachyum*
Western wheatgrass - *Agropyron smithii*

Forbs

Drylander alfalfa - *Medicago amedia*
Scarlet globemallow - *Sphaeralcea coccinea*
Prostate summer cyprus - (Russian variety)

Legumes

Cicer milkvetch - *Astragalus cicer*
Utah sweetvetch - *Hedysarum boreale* var. *germinale*
Yellow sweetclover - *Melilotus officinalis*

Shrubs

Antelope bitterbrush - *Pursia tridentata*
Four-wing saltbush - *Atriplex canescens*
Rubber rabbitbrush - *Chrysothamnus nauseosus*
Sagebrush - *Artemisia tridentata*
Winterfat - *Ceratoides lanata*
Shadscale - *Atriplex confertifolia*